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THE FUTURE WHEAT SUPPLY OF THE UNITED STATES¹

THE subject of our future wheat supply is seen at once to involve four separate questions, as follows: (1) What is the possible increase in production that may be attained? (2) How may it be attained? (3) What is the probability of such attainment? (4) Will this production satisfy the demand?

It is evident also that no tangible benefit can come to the reader of any discussion of this subject which does not have application to some definite period of time. It is assumed, therefore, in this present discussion that we are concerned with movements in the next forty years—or a period closing with the year 1950.

POSSIBLE INCREASE IN WHEAT PRODUCTION

An increase in wheat production can arise in two ways: (1) By an increase in the wheat acreage, and (2) by an increase in acre yields.

INCREASING THE WHEAT ACREAGE.

The wheat acreage may be increased through an expansion in the farm area and also by devoting a larger percentage of the present farm area to wheat.

Expansion of the Farm Area.—The total land area of the United States is 1,900,947,200 acres. By the census of 1900 it was shown that at that time 44.1 per cent. of this area, or 838,591,774 acres, was included in farms. The farms were of all sizes, and of course were not entirely cultivated, many of them in fact, being large

¹ Read before the Millers' National Federation Mass Convention at Minneapolis, June 22, 1910.

stock ranges. The following table shows a rapid development from 1850 up to that time, and gives the total farm acreage, the improved farm acreage and the wheat acreage for each census year that they were determined, also the percentage each of these comprises of the total land area.²

Year	Farms		Improved		Wheat	
	Acreage	Percentage	Acreage	Percentage	Acreage	Percentage
1900	838,591,774	44.1	414,498,487	21.8	41,971,000	2.2
1890	623,218,619	32.8	357,616,755	18.8	37,275,000	2.0
1880	536,081,835	28.2	284,771,042	15.0	31,912,000	1.7
1870	407,735,041	21.4	188,921,099	9.9	18,386,000	1.0
1860	407,212,538	21.4	163,110,720	8.6	15,424,496 ³	.8
1850	293,560,614	15.4	113,032,614	6.0		

Since 1900 there is no definite statement of farm acreage. A fair estimate can be made, however, for the present year. The "yearly disposal of public lands for cash" for the period 1900-1908 amounted to 164,159,599 acres. Practically all or nearly all these lands go into farms.⁴ Lands similarly disposed of in Texas, according to the reports of the commissioner of the Texas general land office, amounted to 22,470,856 acres from September 1, 1900, to August 31, 1908. Considering now the later additions from these two sources, to-

²The facts are taken from the Statistical Abstract of the United States, pp. 119-121, except wheat acreages, which are calculated as ten-year averages from regular reports of the Bureau of Statistics, U. S. Department of Agriculture. For the census years of 1880, 1890 and 1900, averages for the periods 1874-1883, 1884-1893 and 1894-1903, respectively, are employed, and for 1870 the average for the period 1866-1871, as the figures for wheat acreage in this period do not go back farther than 1866.

³This sum is the acreage for 1866.

⁴They include original homestead entries, as much the larger portion, timber culture claims, lands obtained with agricultural college and other scrip and under military bounty land warrants, and lands (a comparatively small amount) selected by states and railroads. (See Statistical Abstract of United States, pp. 24-25.)

gether with the large tracts of railroad lands sold to new settlers in recent years, particularly in Kansas, Nebraska and Colorado, it appears that at least 200,000,000 acres have been added to the farm area since 1900. This would make the total farm area for 1910 about 1,050,000,000

acres, or approximately 55 per cent. of the total land area. If so, the increase is greater than in any other decennial period except the preceding, 1890-1900.

The question then is, how much additional farm area may be expected in the future. Certainly not a great deal, but I believe much more than many suppose. Again the amount may be estimated, but this time more roughly, and the area may not be fully occupied for many years.

According to the Report of the General Land Office for 1908, there were at that time, exclusive of Alaska, 386,873,787 acres of government lands "unappropriated and unreserved." Though these lands include all kinds, agricultural, grazing, mineral, etc., surveys and estimates of state officials make it probable that 75,000,000 to 100,000,000 acres will be included in farms. There will be other additions from present Indian reservations. At the close of the fiscal year 1908 there were 52,013,000 acres of Indian lands "unallotted and unreserved," and these are generally better than the usual run of western lands.⁵ We are apt to overlook also the large amount of

⁵See Report of Commissioner of Indian Affairs, 1908, pp. 149-164.

swamp lands in the United States that may be reclaimed and used in profitable agriculture. The total area of these lands is over 79,000,000 acres.* Wherever these lie in the wheat districts they may be so drained as to be profitably used for wheat, as the nature of the soil will be such, no doubt, that they will be very productive. Add to all these figures the natural expansion of farm area in the older states, which amount will hereafter be proportionally greater than heretofore, and it seems reasonable to expect 250,000,000 to 300,000,000 acres of additional farm area even in the next twenty-five to thirty years. By 1950, therefore, the most conservative estimate would make the total farm area of the United States more than 1,300,000,000 acres, or about 70 per cent. of the total land area.

The improved farm area has heretofore been about half of the total farm area, but will hereafter increase more rapidly than the latter. By 1950 it should therefore reach at least 40 per cent. of the total land area, or about 760,000,000 acres.

Percentage of Farm Area in Wheat.—The percentage of total farm area employed for wheat has been as follows: In 1870, 4.5 per cent.; in 1880, almost 6 per cent.; in 1890, practically the same as in 1880; and in 1900, 5 per cent. At present it is approximately 4.8 per cent. The average proportion to date has been, therefore, 5.2 per cent. This percentage of the future possible farm area would be over 69,000,000 acres, or 22,000,000 acres more than the acreage of 1909. That is the amount of future wheat acreage that is entirely possible, simply on the basis of an increase in farm area up to 1,330,000,000 acres.

Increase of Wheat Acreage within the

* Senate Document No. 443, Sixtieth Congress, first session.

same Farm Area.—There is hardly a doubt, however, that the percentage of farm area devoted to wheat will itself increase. Previously there was a period when the proportion was almost 6 per cent., but which was followed by a period of great wheat depression in the nineties. Then, even after a revival in wheat acreage, the proportion of farm area thus employed continued decreasing because of the tremendous increase in the number of farms

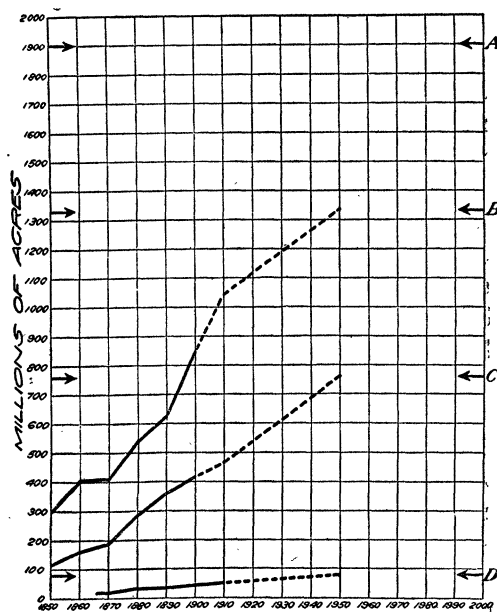


FIG. 1. Diagram showing increases in farm area (upper line), in improved farm area (middle line) and in wheat acreage (lower line) that may occur by 1950, conservatively estimated. A, absolute limit of land area; B, probable farm area in 1950; C, probable improved farm area in 1950; D, probable wheat acreage in 1950.

toward the end of the century. Already the percentage is again increasing, from nearly 4.5 per cent. in 1909 to 4.8 per cent. in 1910. Long before 1950 the proportion should easily reach 6 per cent. again, both because of probable wheat expansion due to increase in prices and because the farm

area will hereafter increase less rapidly. Much of the increase in wheat acreage will occur in the older states, this being now true for the year 1910. We have for the first time reached the 50-million mark, the acreage this year being 50,500,000 acres. In 1950 at the rate of 6 per cent. on a farm area of 1,330,000,000 acres, our wheat acreage should be about 80,000,000 acres. The accompanying figure illustrates the conditions that may exist by 1950, based upon conservative estimates.

An estimation of the possible wheat acreage by 1950 may be calculated in another way. From the above table it will be noted that the percentage of the total land area in wheat has increased each decade on an average over .3 per cent.—to be accurate, .34 per cent. This percentage for the period 1900–1909 is now known to be 2.5 per cent. If we add to this the same rate of increase for each future decade from 1910 to 1950, the percentage will reach 3.86 per cent. It is likely to be a little greater, as we are no doubt now entering a period of considerable wheat expansion. It is conservative, therefore, to assume a wheat acreage of at least 4 per cent. of the total land area in 1950, or 76,000,000 acres, an amount almost equal to the other estimate.

INCREASE IN PRODUCTION ON THE SAME ACREAGE

An erroneous opinion has widely prevailed for some time to the effect that the yield of wheat to the acre in the United States is decreasing. On the contrary, there has been a considerable increase, amounting to 1.8 bushels in the past forty years. Considering the past thirty years, only, the increase has been fully 2 bushels per acre, the yield during the second decade having been less than that of the first. It is really more accurate, however, to calculate from this second decade of 1880–1889 than from the first, as it was during

the second period that the great extension of the wheat area into the great plains and western mountain states occurred, and hence it was only by this time that average yields would fully represent the entire country. Two bushels increase on each of 46,678,400 acres, the present average wheat acreage, equals over 93,000,000 bushels, which is the present increase in production over what it would be at the acre yield prevailing thirty years ago. The present average yield is 14.1 bushels. At the same rate of increase above mentioned, this yield should increase to 16.8 bushels in 1950.

It must be remembered, however, that each decade there is a much more rapid diffusion of knowledge of improved methods of culture, seed selection, use of better varieties, etc., and all farming will become constantly more intensive. An actual increase in acre yield, therefore, of six bushels by 1950 ought to be a fair estimate, thus raising it to 20 bushels. At this acre yield the 80,000,000 acres of wheat in 1950 would produce 1,600,000,000 bushels.

MEANS OF INCREASING ACRE YIELDS

The increase of 2 bushels in yield per acre attained during the past thirty years has resulted without question through certain improvements in wheat culture, as the soil and climate have probably become at least no better. The means of accomplishing these improvements are chiefly three: (1) the introduction of better adapted varieties, (2) hybridization and selection in existing varieties and (3) better methods of cultivation.

Introduction of New Varieties.—Up to the present time by far the greatest improvement has been made through the introduction of new wheats. As early as 1819 the U. S. Department of Agriculture imported the Mediterranean, a semi-hard winter wheat, which was afterwards so

commonly grown in southern Pennsylvania, and in more recent years has been the popular wheat of northern Texas. The Sonora from Mexico and the Australian from Australia are good examples of introductions into California and the southern Rocky Mountain states, which became afterwards important standard varieties.

The great introductions, however, that have been revolutionary in their influence on the wheat industry of this country, and have made landmarks in history, are those of the Fife brought from eastern Europe through Scotland and Canada into the northern states of the plains, and the Crimean or Turkey brought from the Crimea and established in the middle states of the plains. The combined output of these two types of wheat now comprises nearly half the entire wheat production of the country. These introductions have in each instance been the foundation of an enormous milling business, and have without doubt added to the wheat production of the two areas combined 40 to 60 million more bushels than would have resulted from the use of other wheats previously grown. New introductions may increase wheat production by increasing both the wheat area and the acre yield. Often better adapted varieties will make their way into new localities where the conditions are so severe that other wheats would not usually succeed. This has been true in the introduction of the Crimean wheats into the middle states of the plains, both at the beginning and in later introductions of hardier strains. A particularly good example is that of the Kharkov strain introduced by the U. S. Department of Agriculture, which now furnishes an annual addition of at least 20,000,000 bushels of the present hard winter wheat production by extending the area to the north and west and by increasing the acre yield.

Similar to the influence of the Crimean wheat introduction has been that of the durum. Here we have the best example yet known of adaptation to severe conditions. By penetrating localities so dry that other wheats would not survive, and by an increase of acre yields from 20 to 50 per cent., the introduction of this type of wheat has added about 30,000,000 bushels annually to the wheat production of the great plains.

One of the best examples of improvements yet possible is found in the conditions surrounding the grain grower and miller in California. The wheats commonly grown there, Australian, California Club and Sonora, are very deficient in gluten usually, though there is considerable variation in this respect in varieties and localities. To comply with the demands of the flour markets, therefore, the miller imports wheat of greater baking strength from the hard wheat areas of the great plains to the extent of nearly or quite half of all he uses. This condition is in face of the fact that California *can* produce all the wheat she needs and has done so formerly. As early as 1878 the production was nearly four times that of the present. While bad practises of cultivation are largely responsible for present low yields, there is great need of new varieties in general cultivation, giving better yields and better flour.

It is pleasant to be able to announce here that exactly the varieties for these purposes have been found, and only an increase in the seed is now needed to give California a wheat ranking well in commercial quality with any other in the country. These varieties are the Chul and Fretes, introduced by the U. S. Department of Agriculture from Turkestan and Algeria, respectively. They not only stand high in quality, but yield much better than any of the native wheats. Chul

appears to be a little the best. With the general use of these wheats and better farming operations it will be easy to raise the production in California to the old-time figures of 40,000,000 bushels, by making wheat growing profitable.

Improvements in Existing Varieties.—Both the native and introduced wheats are capable of being greatly improved by continuous selection of the best individuals and by hybridization with each other. This work is practically in its infancy, though considerable progress has been made. Some of the best known new wheats produced by hybridization are those originated by A. N. Jones in New York, one of which, Jones's Winter Fife, is widely grown. Mr. Pringle, of Vermont, also produced several new wheats of importance, the well-known Defiance, a spring wheat, being the best.

Of selected wheats, the one most commonly grown to-day is the Fultz, developed by Abraham Fultz in Pennsylvania. It is now a standard variety in all winter wheat districts, though being rapidly supplanted in some localities by hardier sorts. The selection work done at the Minnesota Experiment Station, resulting in the new strains, Nos. 163, 169, etc., has had the greatest influence of all work of this kind on wheat production, and has greatly increased the spring wheat yield. Much of this improvement has been accomplished in cooperation with the U. S. Department of Agriculture.

Improvements in Methods of Farming.—There is no doubt that much of the increase in acre yields already attained is due to improved farming methods. Yet improvements in this line are only fairly begun. The size of farms will continue to be curtailed, and operations will become more careful and intensive. The wheat acreage may thus be slightly lessened in some

places, but this will be more than counterbalanced by better results from each acre. More complex and better adapted systems of farm management are being adopted, which require careful rotations of crops, better tillage and use of waste products.

Récent interest in "dry farming," so-called, is resulting in a rapid diffusion of the knowledge of proper methods of cultivation for conservation of moisture. There will grow out of this a considerable further increase in yield in the dry districts and a further extension of the wheat area into localities still drier, where agriculture in general is now considered to be at best very uncertain. It may be of interest to the millers to know that the U. S. Department of Agriculture has under way extensive series of experiments in just this line of investigations at fourteen points in the western great plains and intermountain districts. Hundreds of dry-land wheats also are being studied and selected on these farms.

The use of legumes and other crops to be plowed under green to furnish more humus and as renovators of the soil in other respects will be much practised hereafter. In the course of a series of experiments conducted several years in California, by the U. S. Department of Agriculture, part of the time in cooperation with the state experiment station, it has been found that one of the greatest needs of the wheat grower is the use of leguminous crops for the purposes just mentioned and the practice of sowing wheat after green rye plowed under. The yield of wheat per acre following these treatments of the soil was 22 bushels greater than that of wheat following wheat.

PROBABILITY OF INCREASE IN PRODUCTION

We come now to the question which, after all our efforts with estimates, is the most difficult to answer. What is the

probability that the great increase in wheat production through increases in the acreage and in acre yields that are entirely *possible*, will be *realized*, either in whole or even in large part? In fact, it can not be answered definitely. That which is possible may not be at all probable. One can risk an opinion, however, on the basis of the facts at hand, and in the present case the chances seem strong that something near the increase in wheat production previously discussed will be realized. There are two good arguments that may be used in support of this opinion. The first is deduced from the facts of past conditions. It is almost an axiom in common philosophy that the trend of events in future over a long period of time will be about the same as in the past.

WHEAT EXPANSION AND DEPRESSION

In the past the tendency in most movements has been both upward and downward in wave-like motion, crest following

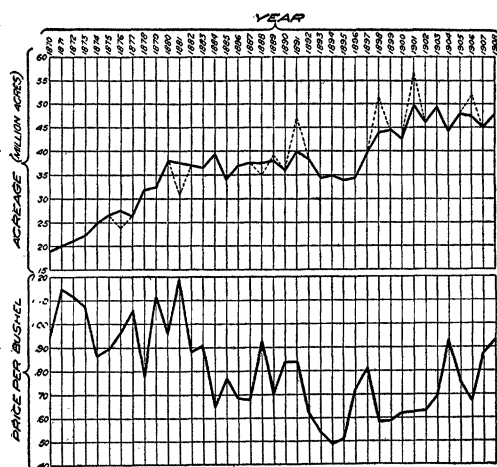


FIG. 2. Diagram showing variations in wheat acreage and prices for 39 years, from 1870 to 1908. The upper line represents the trend of wheat acreage (in millions of acres) and the lower that of prices (in cents per bushel). From left to right are shown the different years.

depression and depression following crest, though on the whole there may have been advancement. The movement of wheat acreages and prices has followed this rule, and, therefore, it is reasonable to suppose, will continue to follow it. These wave-like movements are often complicated by the fact that many small ones may be involved within one large one. A careful study of the course of wheat acreages and prices in this country for the past forty years will nicely illustrate these statements.

Almost constantly large wheat acreages and accompanying low prices have been followed by diminished acreages and accompanying high prices, and so on. An unusual period of wheat expansion occurred during the years 1881 to 1892, followed by a period of great depression in 1893-96. During both these periods and since 1896 many minor movements up and down occurred. We are now apparently entering a period of considerable wheat expansion, and naturally enough prices are falling. It is simply the old question of supply and demand. The farmer can not be blamed if he grows what is most profitable. If the demand is great, and prices increase, and wheat growing is profitable, the farmer will grow wheat. It was simply in recognition of this general principle that Mr. Patten and his associates over a year ago, foreseeing a necessary rise in prices, were able to make a good "clean-up"; but it was not the fault of this same principle when, a year afterwards, the same parties, turning too late from the oncoming wave-crest of wheat, were caught and a good portion of their previous gain washed away.

The final result of the up-and-down movement to date has been a greatly increased wheat production. It is reasonable, therefore, to expect the same thing

in future, but we shall also experience similar temporary fluctuations.

ANALOGIES FROM CONDITIONS IN OLDER COUNTRIES

The opinion that a constant increase in production will continue in future and that the foregoing estimate of the amount of this increase is very conservative is greatly strengthened through reasoning by analogy from conditions now existing in older countries. Some of these countries are now at the stage of development in agricultural resources that this country should not reach for many years. Therefore the conditions as to supplies of different crops existing in those countries to-day should give us an approximate idea of what we may expect.

PERCENTAGE OF TOTAL LAND AREA IN WHEAT

Mention is made above of the method of estimating the future wheat production from the gradual but constant increase in the percentage of total land area heretofore employed for wheat, and it is stated that 4 per cent. should be a conservative estimate of the proportion of total land area that will be so employed by 1950. Statistics of other countries appear to show by comparison that such an estimate is very mild. The following figures give the percentage of total land area now being employed for wheat in a number of important countries.

Country	Percentage of Total Land Area in Wheat	Country	Percentage of Total Land Area in Wheat
United Kingdom	3.1	Japan	1.2
Austria	3.7	Netherlands	1.8
Hungary	11.2	Roumania	14.5
Belgium	5.1	Russia (European)	3.9
Bulgaria	8.4	Servia	7.5
Denmark	1.0	Spain	7.3
France	12.3	Argentina	1.9
Germany	3.5	British India	4.9
Italy	16.5	Manitoba	6.6

It is seen that the percentage in other countries runs from 1 per cent. in case of Denmark to even 16.5 per cent. in case of Italy. Spain is considerably mountainous, but employs 7.3 per cent. of her total land for wheat. Hungary uses 11.2 per cent. The United Kingdom, though not naturally a wheat country, practising greatly diversified farming and having much meadow land, yet devotes 3.1 per cent. of her land to wheat—.6 per cent. more than the proportion we now employ. It may be objected that our immense corn crop must be considered, absorbing a large area which in other countries can be given to wheat, also that in importing countries, like Italy and the United Kingdom, the insufficiency of supply itself furnishes a stronger incentive for wheat growing. This argument, however, is of no use, for Roumania has a large wheat export in proportion to her size, grows three times as much corn per square mile as the United States, yet devotes 14.5 per cent. of her land to wheat. Servia, though growing much more corn than wheat, nevertheless employs 7.5 per cent. of the land for the latter. In Russia and Germany much the largest grain crop is rye, the acreage in the latter country comprising 10 per cent. of the area; yet Germany, with much waste land, and comparatively large oat and barley acreages, devotes 3.5 per cent. to wheat, while Russia employs 3.9 per cent. for wheat, though growing also more barley than any other country, and more rye than all other countries combined.

An average of the percentages of land in wheat in these countries is almost 6.4 per cent., which would seem to be a fair indication of the proportion of our own land that may be sown to wheat many years hence, provided there is sufficient demand. That percentage would give us approximately over 120,000,000 acres, or 25,-

000,000 more acres than are now given to corn, and much more than twice the present wheat area.

ACRE YIELDS IN OTHER COUNTRIES

Statistics of other countries show also that the limit of possible yield per acre of 20 bushels previously estimated for 1950 is much below what has been attained elsewhere. Germany now produces 28.7 bushels of wheat to the acre, while in the United Kingdom the average is 32.6 bushels (Winchester). In France the acre yield is 20.4 bushels.

RECENT INCREASES IN OTHER COUNTRIES

To show that increases in area and yield may go on in later years, it should be noted further that much recent progress has been made in other countries. For example, in Hungary, one of the oldest wheat countries, the acreage has increased even since 1884, from 6,797,800 acres that year to 9,474,415 acres in 1908. In European Russia it has increased from 39,711,200 acres in 1894 to 62,766,700 acres in 1908. In smaller countries the acreage increases have been as follows: Roumania, 2,903,700 acres (1886) to 4,452,000 acres (1908); Bulgaria, 2,167,200 acres (1897) to 2,422,700 acres (1908); Servia, 783,500 acres (1893) to 931,300 acres (1908).

Likewise have the acre yields increased. In the United Kingdom, where farming is so intensive that it would seem hardly possible in late years to get anything more from the soil, nevertheless, the yield has increased during the past ten years almost 2 bushels. In France it has increased over 2 bushels in the same period, in Austria 3 bushels, and in Germany the astonishing amount of 5.2 bushels.

WILL FUTURE PRODUCTION EQUAL OR EXCEED THE DEMAND?

Future demand, of course, depends upon the population and per capita consump-

tion. At the outset, it may be remarked that the increase in our future population, as stated by some parties, appears to be much over-estimated.

The census population figures for continental United States show that, starting with an increase of nearly 12,000,000 from 1870 to 1880, the succeeding increases have been rather constantly about 1,000,000 more for each ten years than for the preceding ten years. At this rate of gain, beginning with a commonly estimated population of 90,000,000 for 1910, this being an increase of 14,000,000 over that of the preceding census, the figures for 1950 should be about 156,000,000. Allowing for a considerably higher rate of increase, however, we may, for safer calculation, assume it to be 160,000,000.

The home consumption of wheat per capita in this country, including seed and wheat flour (at $4\frac{1}{2}$ bushels per barrel), has been as follows: 1870, 5.02 bushels; 1880, 5.52 bushels; 1890, 5.49 bushels; 1900, 5.11 bushels. The same is estimated to have been about 6.39 bushels in 1906 and 6.34 bushels in 1908. There has been much fluctuation, and the figures may settle at about 6 bushels for 1910 or perhaps more. Anyway, there has been apparently an increase of about 1 bushel in our per capita consumption since 1870. We may suppose an equal increase in the equal period of the next forty years, making 7 bushels for 1950, though it may be considerably less.

At the rate of 7 bushels per capita a population of 160,000,000 will require 1,120,000,000 bushels of wheat. This amount taken from the production of 1,600,000,000 bushels above estimated for that year, and which is shown to be very conservative, leaves a surplus of 480,000,000 bushels. Some predictions of our future population have placed it much higher than 160,000,000 for 1950, one making it as high as 200,-

000,000. Supposing this last to be correct, at 7 bushels per capita, that population would require 1,400,000,000 bushels, leaving still a surplus of 200,000,000 bushels. Again, if we assume that there will be a greater increase in per capita consumption resulting in as much as 8 bushels by 1950, the amount required at home at this rate would be 1,280,000,000 bushels, leaving a surplus of 320,000,000 bushels. Supposing both contentions of the larger increases in population and consumption should be true, which is extremely improbable, the demand would just equal the supply.

POSSIBLE INCREASE IN PRODUCTION IN OTHER COUNTRIES

A complete view of the situation as to future wheat supply requires some consideration of world production, even though our own production may be more than sufficient for home demand. Except in unusual instances, prices, export, etc., are affected by world conditions. It is an important question whether we may continue to expect an occasional surplus in the world's crop.

There are only three regions that, for many years, will have any considerable part in furnishing a world surplus. All other countries will, at most, no more than supply themselves: These regions are (1) the plains of North America; the "black earth" of eastern Europe and including a large indefinite area in Siberia, and (3) Argentina.

The most important of these regions, for the present, is in North America, and a large part of it lies outside of the United States in Canada. Canadian production is of particular importance to us, as it offers a near source of supply in case of a possible temporary shortage of our own crop.

A careful study of the conditions in

Canada reveals a possibility in increased production far ahead of any other present exporting country. Outside of Manitoba wheat production has only fairly begun, and yet the entire production can be made as large as that of the United States at present. The undeveloped resources of Alberta and Saskatchewan are very great. These two provinces and Manitoba are of chief present importance in grain production. The available farm area of the two larger provinces, based upon reports of provincial officials, is about 250,000,000 acres out of a total land area of 310,000,000 acres. This farm land would furnish a similar proportion for wheat as now employed in Minnesota and Kansas, or about one ninth of the area. This should be particularly capable of attainment because of the impossibility of any considerable corn production. One ninth of this farm area will furnish a wheat area of almost 28,000,000 acres. Manitoba employs now almost 3,000,000 acres. A conservative estimate, therefore, may be made, in round numbers, of 30,000,000 acres as the possible wheat acreage for these three provinces in 1950. The present average yield per acre of both spring and winter wheat for the three provinces, calculated from previous ten-year records, appears to be about 22 bushels, which should increase to at least 25 bushels. This rate of yield would allow a total annual production of 750,000,000 bushels, of which over 600,000,000 bushels would be an increase over present production. This possibility leaves out the increases that will occur in older provinces and the possible production in northeastern British Columbia and the Northwest Territory.

The possibility of wheat cultivation even in northern Alberta is not a matter of theory, but has been fully tested. In the year 1908, 35,000 bushels of wheat were already

grown in the vicinity of Ft. Vermillion at an average yield of 24 bushels per acre. Two stone mills and a modern roller mill are established at this point, which is 350 miles north of Edmonton. The wheat grown is probably not the best but appears to be of fair quality and has a fine appearance.

A similar line of reasoning to that in the above statements, which will not be given here in the desire for brevity, will lead one to the conclusion that European Russia may increase her production at least 600,000,000 bushels or to a total of 1,300,000,000 bushels. Argentina's wheat production has increased with unusual rapidity since 1904, reaching now an average of over 150,000,000 bushels. Three times that amount, or 450,000,000 bushels, is a low mark to set for that country's attainment by 1950. The most perfectly adapted area of the country for wheat lies in the southern part—old Patagonia—and is yet largely unexploited agriculturally. The wheats of best quality so far produced in Argentina come from the Chubut district in the northern part of this area.

The possible increases in foreign production just mentioned amount to about 1,500,000,000 bushels, which, added to the 900,000,000 bushels increase estimated for this country, gives a total of 2,400,000,000 bushels increase in production for the chief exporting countries. On the basis of previous relations of population to wheat production, and considering the increase in substitute foods that is sure to occur, the world will require, we may suppose, about 5,500,000,000 bushels of wheat by 1950, an increase of 2,000,000,000 bushels over present production. The above estimated total increase more than satisfies this requirement.

M. A. CARLETON

U. S. DEPARTMENT OF AGRICULTURE

MISS MATILDA H. SMITH

THE older members of the American Association will learn with regret of the death of Miss Matilda H. Smith, of Pittsburgh, Pa.

Miss Smith, with her sister, Miss Jennie M. Smith, has frequently been in attendance at the meetings in past years and has always taken a great interest in the advancement of science in a broad way.

Some years ago, they thought out a very original plan by which to aid the association in its general aims and at the same time to encourage certain scientific men of merit but of small income. This plan was to pay the life membership fee to the permanent secretary for certain men selected by themselves, often after consultation with Dr. Brashear.

A very considerable number of the life members of the Association owe their life memberships to this unobtrusive generosity on the part of the Misses Smith, and the permanent funds of the association, the income of which is devoted to the advancement of scientific research, has been considerably enlarged in this way.

Those of the members of the association who have been fortunate enough to enjoy the acquaintance of Miss Smith will miss her greatly.

L. O. H.

THE SUMMER MEETING OF SECTION E OF THE AMERICAN ASSOCIATION

THE following notice has been sent to all geologists and geographers, some 950 in number:

For several reasons it has been decided to hold no summer meeting of Section E early in July. (1) These summer meetings have been attended so largely by educators in the eastern states that it seemed unwise to hold a summer meeting at the time of the meeting of the National Education Association, the week beginning July 4. (2) Mr. R. W. Brock, director of the Canadian Survey, has decided that it will be impossible to hold a meeting in Canada this summer as was suggested at the Boston meeting. (3) Many geologists will attend the National Geologic Congress in August and September.

The geologists and geographers were asked to express their opinion in regard to the wis-